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IS 11585-1 (1986): Insulated Stainless Steel Silos for Milk Storage, Part 1: Capacities 60000 and 100000 Litres [FAD 19: Dairy Products and Equipment]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

**SPECIFICATION FOR
INSULATED STAINLESS STEEL
SILOS FOR MILK STORAGE**

PART I CAPACITIES 60 000 AND 100 000 LITRES

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**INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002**

Indian Standard

SPECIFICATION FOR INSULATED STAINLESS STEEL SILOS FOR MILK STORAGE

PART 1 CAPACITIES 60 000 AND 100 000 LITRES

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IS : 11585 (Part 1) - 1986

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Indian Standard
**SPECIFICATION FOR
INSULATED STAINLESS STEEL
SILOS FOR MILK STORAGE**

PART 1 CAPACITIES 60 000 AND 100 000 LITRES

0. FOREWORD

0.1 This Indian Standard (Part 1) was adopted by the Indian Standards Institution on 17 February 1986, after the draft finalized by the Dairy Equipment Sectional Committee had been approved by the Agricultural and Food Division Council.

0.2 The insulated stainless steel milk storage tanks are widely used to store milk and liquid milk products which have already been cooled. These storage tanks are required to hold the products without any appreciable rise in the product temperature. There are two types of such tanks, namely, horizontal tanks and vertical cylindrical tanks. IS:2688-1964* covers vertical tanks in one size only, namely, 2 000 litre capacity. IS:4938-1968† covers milk storage tanks of vertical cylindrical shape of capacity 10 000 and 15 000 litres. This standard (Part 1) covers milk storage silos of vertical cylindrical shape of capacities 60 000 and 100 000 litres. The silos of capacity 150 000 and 200 000 litres would be covered in Part 2 of this standard and those of 30 000 litres would be included in IS:4938-1968‡. Such silos are being increasingly used as they occupy less floor space.

0.3 This standard contains **4.2, 3.2, 5.2, 5.3, 5.11, 7.2.3, 7.2.5, 7.2.9, 7.2.10, 8.1** and **9.1** which call for an agreement between the purchaser and the manufacturer.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS:2-1960‡. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Specification for insulated stainless steel milk storage tank.

†Specification for insulated stainless steel milk storage tanks vertical type.

‡Rules for rounding off numerical values (revised).

1. SCOPE

1.1 This standard (Part 1) prescribes the requirements for insulated stainless steel vertical silos for milk and milk products storage of 60 000 and 100 000 litres capacities.

2. TERMINOLOGY

2.1 For the purpose of this standard, silos shall mean as self-supporting cylindrical insulated vessels more than 4 metres high, usually situated outdoors with controls accessible from indoors.

3. CAPACITY

3.1 The rated capacity of the silos shall be 60 000 litres and 100 000 litres.

NOTE — Volume of cylindrical portion above the liquid level and conical top volumes shall be not included while arriving at the rated capacity.

3.2 Ullage Provision — The ullage provision shall be as agreed to between the purchaser and manufacturer. It is recommended that it should not be less than 2 percent.

4. SHAPE AND DIMENSIONS

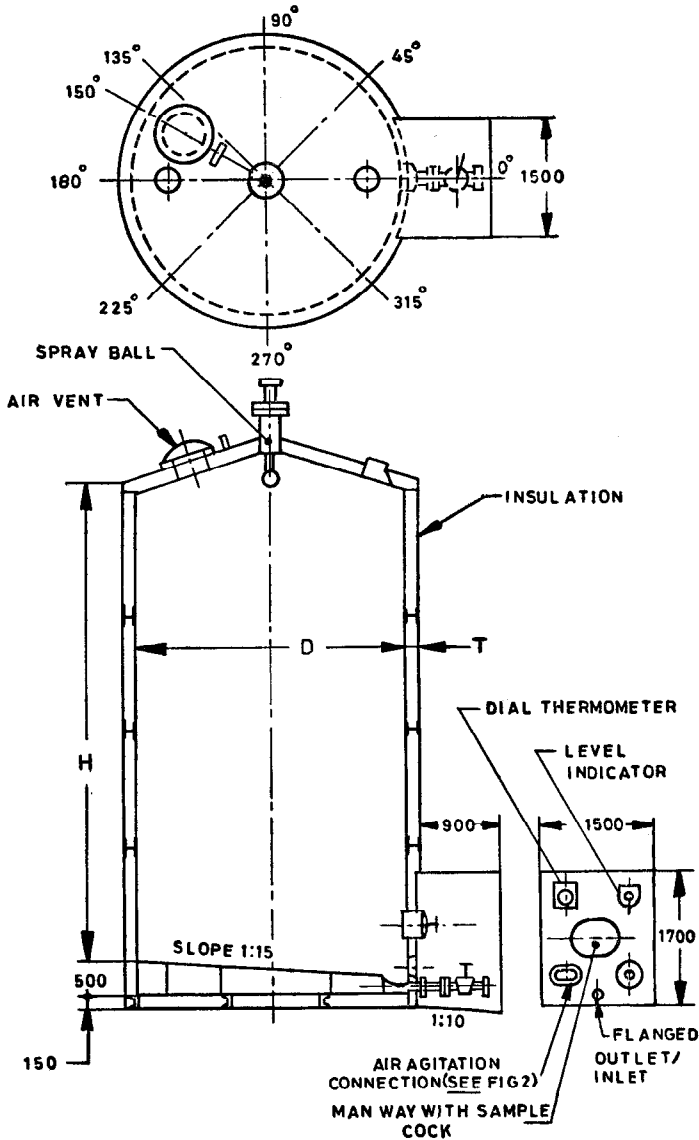
4.1 The silos shall be of vertical cylindrical shape for the body with flat bottom sloping towards the outlet and conical top. The silo shall be directly supported on concrete plinth.

4.2 Recommended dimensions are indicated in the sketch of a typical silo and the agitation systems in Fig. 1 and 2 respectively. Variations in dimensions and shape are permitted by arrangement between the purchaser and the manufacturer.

5. MATERIAL

5.1 Inner Vessel — The inner vessel and all attachments welded to inner vessel shall be of stainless steel conforming to Grade 07Cr18 Ni9 of IS:1570 (Part 5)-1972*. The weld metal shall be as corrosion resistant as the parent metal. The material used shall be not less than 3 mm thick for the cylindrical section and 4 mm thick for the bottom.

*Scheduled for wrought steels for general engineering purposes: Part 5 Stainless and heat-resisting steels (*first revision*).



All dimensions in millimetres.

CAPACITY (in litres)	H	D
60 000	6 300	3 600
10 0000	10 200	3 800

FIG. 1 A TYPICAL SKETCH OF VERTICAL SILO FOR MILK STORAGE

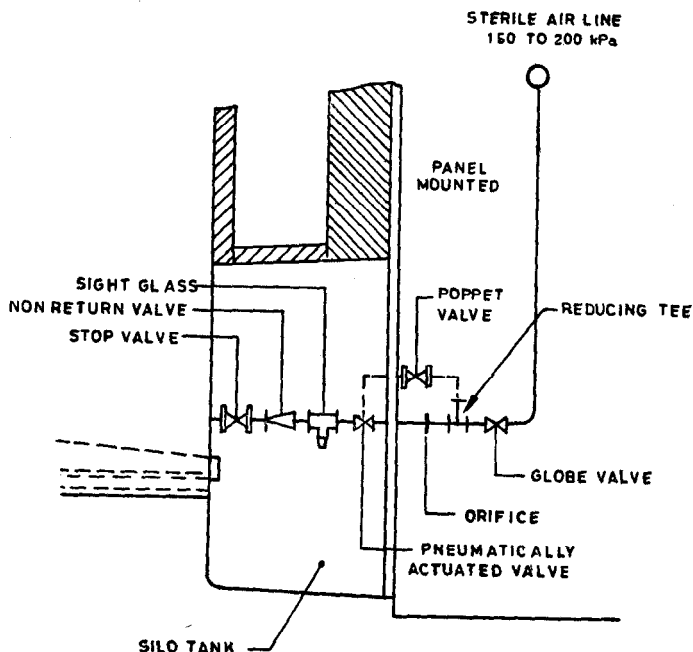


FIG. 2 AIR AGITATION SYSTEM

5.2 Outer Cladding or Shell — The outer cladding or shell may be fabricated from stainless steel [see IS:1570 (Part 5)-1972*] or mild steel (see IS:226-1975†) or cold rolled carbon steel strip annealed (see IS:4030-1973‡) or aluminium alloy (see IS:737-1974§) or re-inforced fibre glass of suitable thickness and strength as agreed to between the purchaser and the manufacturer.

5.3 Insulation — The insulating material shall be as agreed to between the purchaser and the manufacturer. The quality and thickness of the insulating material shall be such as to prevent in 18 hours an average temperature rise of not more than 2°C in the silo full of water when the difference between the temperature of water and the room temperature is 35°C. The

*Scheduled for wrought steels for general engineering purposes: Part 5 Stainless and heat-resisting steels (*first revision*).

†Specification for structural steel (standard quality) (*fifth revision*).

‡Specification for cold rolled carbon steel strip for general engineering purposes (*first revision*).

§Specification for wrought aluminium and aluminium alloys, sheet and strip (for general engineering purposes) (*second revision*).

insulation material shall have thermal conductivity less than 0.326 mW/cm deg (0.028 kcal/m.h °C). Insulation material should not be affected if the silo is sterilized by steam. The above temperature rise shall not take into consideration the sensible heat that may be stored in the empty silo at the time of filling. Before recording temperature, the water shall be gently agitated to make the temperature uniform within the silo.

5.4 Shaft, blades and collar (when fitted in the milk contact zone of the silo) shall be of stainless steel of Grade 07 Cr 18 Ni 9 of IS : 1570 (Part-5)-1972*. The bearings when fitted in the milk contact zone of the tank shall be of a material (metal or non-metal) which shall be non-toxic, relatively stable, non-absorbent and shall not impart any flavour when coming into contact with milk and detergents used in the cleaning process.

5.5 Oil Throw Cup — An oil throw cup or umbrella shall be fitted on a vertical agitator and it shall be fabricated from stainless steel of Grade 07 Cr 18 Ni 9 of IS : 1570 (Part 5)-1972*. The cup may also be of moulded rubber with coiled spring for clamping.

5.6 Outlet and Inlet Cocks — The outlet and inlet cocks shall be made of stainless steel conforming to Grade 07 Cr 18 Ni 9 of IS : 1570 (Part 5)-1972*.

5.7 Manway Assembly — The manway neck ring, door or cover, lifting handle and the clamps shall be made from stainless steel of Grade 07 Cr 18 Ni 9 of IS : 1570 (Part 5)-1972*.

5.8 Vent — The air vent (of 450 mm diameter), the wire gauze and the hood shall be made from stainless steel of Grade 07 Cr 18 Ni 9 of IS : 1570 (Part 5)-1972†.

5.9 Sampling Cocks — Sampling cocks shall be made of stainless steel conforming to Grade 07 Cr 18 Ni 9 of IS : 1570 (Part 5)-1972*.

5.10 Gasket and Sealing Device — Non-metallic material when used for gaskets or for sealing shall be suitable for dairy operations, of food grade, non-toxic, relatively stable (capable of withstanding the sterilizing temperatures up to 98°C) non-absorbent, having a smooth surface; free from patches, blisters, porosity, embedded foreign matter and physical defects. The material shall not impart any flavour or deteriorate when in contact with milk and cleaning agents. The joint sealing rubber should preferably of acrylonitrile butadiene copolymer (NBR) of Type B 3 or polychloroprene of Type C 3 (see IS : 6450-1971†).

5.11 Sight and Light Glass — Sight and light glass, if required by the purchaser shall be made from clear glass. Sight and light glass fittings shall be of stainless steel of Grade 07 Cr 18 Ni 9 of IS : 1570 (Part 5)-1972*.

*Schedule for wrought steels for general engineering purposes: Part 5 Stainless and heat-resisting steels (*first revision*).

†Specification for rubbers for dairy industry.

5.12 Drive Mounting — Mounting for the agitator may be fabricated from carbon steel or cast iron.

6. FABRICATION

6.1 The silo and fittings shall be constructed in accordance with the best hygienic principles applicable to equipment for storage of milk.

6.2 Inner Vessel — The inner vessel shall be of welded construction and of circular cross-section in accordance with sound fabrication principles. Silo and fittings shall be designed and constructed to withstand expansion, contraction and pressure changes consequent upon rapid changes in temperature while cleaning-in-place, filling and emptying. The top shall be strong enough to carry walkway platform, etc. The base shall be of substantial construction suitable for placing directly on level prepared foundation and giving adequate support and shall be fabricated to take the total mass of milk. The welding shall be carried out according to recognized welding techniques. All weld areas and deposited weld metal shall be as corrosion resistant as the parent metal under normal conditions of use, cleaning and sterilization. All surfaces in contact with the contents of the silo shall be smooth and free from crevices and other defects.

6.2.1 All internal corners of cylindrical body and ends shall have a radius not less than 25 mm. Any other inside corner shall have a radius not less than 6 mm. Welds in the bottom end shall be so located as not to interfere with drainage. All welds shall be ground and all internal surfaces polished to a smooth finish. Welds on outside of conical top shall be ground and all outside surfaces polished to a smooth finish. Smooth finish shall be obtained by buffing with IS Grit No. 150 (*see* IS:3178-1965*). The flat bottom of the silos shall have a slope of 6 percent (1 in 16) to facilitate drainage of milk to the outlet and result in complete emptying. The outlet shall be welded to the bottom of the tank and this shall have a sump and shall terminate with a malepart outside the tank through insulation and outer casing. The size of the malepart shall be 63.5 or 76.2 mm (*see* IS:3382-1965†).

6.3 Insulation — The insulation shall be applied so as to eliminate hollow space. The insulation shall be provided in two layers, the joints of the second layer shall be staggered with those of the first layer. The insulation shall cover the bottom and the cylindrical body. The conical top of the tank shall also be insulated externally.

6.4 Outer Cladding or Shell — The outer shell shall be completely sealed so as to avoid penetration of moisture or vermin to the insulation. The bottom periphery of the cylindrical portion should extend in the form of skirt extending 51 mm below the bottom of the silo.

*Specification for abrasive emery grain.

†Specification for stainless steel milk pipes and fittings.

7. FITTINGS AND MOUNTINGS

7.1 All fittings and mountings (excluding welded on connections and thermopocket), probes, sensing elements and components of agitator which come into contact with milk in the silo shall be capable of being easily dismantled or suitably designed for cleaning or in-place-cleaning and sterilizing purposes. The fittings required for daily operations and controls shall be easily accessible.

7.2 The fittings and mountings for the silo shall comprise the following.

7.2.1 Inlet and Outlet — These shall be provided at the bottom of the tank. The diameter shall not be less than 63.0 mm up to 60 000 litres capacity and shall be of 76.2 mm in case of larger sizes (see IS: 3382-1965*). This connection may be used for bottom filling and emptying as top fitted foamless inlets are not commonly used; for simultaneous filling and emptying operations, twin inlet/outlet may be used.

7.2.2 Vent — A permanently open and self-draining vent of the size appropriate to the filling and emptying conditions and pump capacity shall be fitted on the top of the silo to relieve pressure or vacuum within the silo. This vent should take care of the pressure changes during in-place-cleaning operations. It shall be protected from ingress of vermin by a wire mesh cover. The vent shall also be protected by a hood to prevent any dirt or other particles falling from above.

7.2.3 A contents gauge, level indicator and low and high level alarms may be provided on the tank, if desired by the purchaser. The type and the manner of fixing the gauge shall be as agreed to between the purchaser and the manufacturer. These shall be of hygienic designed and suitable for in-place-cleaning.

7.2.4 The tank may be calibrated, if required by the purchaser, for the rated capacity. The full cylindrical part of the silo shall be calibrated in such a manner that there is a clear marking after every 1 000 litres. The calibration should be done on a sand blasted area so that the calibrations are clearly visible from the sight glass.

7.2.5 Thermopocket — A welded-on thermopocket shall be provided on the body of the tank. It shall be so placed that is possible to take temperature reading even when the tank is full to only one tenth of its capacity. A dial type indicating thermometer shall be used for indicating the temperature. The thermometer shall be suitably mounted. If desired by the purchaser, a temperature recorder may also be provided.

7.2.6 Manway Assembly and Cover — The elliptical manway having dimensions of 510 × 380 mm shall be located in the alcove. The manway cover should open inwards and shall be easily accessible through alcove, if provided. The manway cover shall have rubber joint ring (see 5.10).

*Specification for stainless steel milk pipes and fittings.

7.2.7 Connection for Detergent — The top of the tank shall be provided with a suitably sized inlet connection termination with a malepart. Through this connection shall be fitted a detergent spraying device of the fixed ball type.

7.2.8 Agitation — Effective agitation shall be provided by means of air. The air shall be oil-free, pre-filtered dust-free and clean. The speed of the agitation and the design shall be such that the operation shall not churn the milk while effectively agitating the entire contents, in such a way that a truly representative sample may be drawn from any point in the silo.

7.2.9 Ladder — An aluminium or stainless steel access ladder with sufficient number of supports capable of being removed from the silo may be fitted to the inside of the silo. The bottom of the ladder support shall be provided with rubber or other non-metallic pads. An outside ladder and/or a platform may be provided if desired by the purchaser.

7.2.10 Inspection Facilities — If desired by the purchaser, either a combined light and sight glass of a suitable size or separate sight and light glasses of suitable sizes should be provided and so positioned as to provide full view of the inside of silo.

7.2.11 Sampling Cocks — Sampling cocks of suitable size and of sanitary design should be provided in the manway and so positioned as to enable the sample to be taken even when only 5 percent of the full capacity of the silo is full.

7.2.12 Alcove — Controls like level transmitter, thermometer, manway, cleaning-in-place connection and interlock, etc, should be housed in a alcove cabinet accessible from process hall for easy attendance.

8. FINISH

8.1 Finish of Mild Carbon Steel Parts — All mild steel internal surfaces of the outer casing and the supports shall be painted with two coats of anti-rust paint. In case of carbon steel outer shell, all outside surfaces shall be cleaned, spray galvanized and painted with anti-rust paint and finished with two coats of enamel paint of colour as approved by the purchaser.

8.2 Finish of Stainless Steel Parts — All the stainless steel surfaces shall be of sanitary finish and finished smooth by buffing with IS Grit No. 150 (see IS: 3178-1965*).

*Specification for abrasive emery grain.

9. TEST

9.1 As agreed to between the purchaser and the manufacturers, the base of the tank and weld seams and the quality of welds shall be subjected to dye penetration test (*see* IS:3658-1981*) or other suitable test at a suitable stage of manufacture to determine that it is free from leaks. The dye penetration test shall be carried out prior to the application of insulation material to the inner vessel. Radiographic test at the joints may also be carried out as agreed to between the purchaser and the manufacturer (*see* IS: 1182-1983† and IS:4853-1982‡).

9.2 The inner shell of the silo shall be tested for water tightness in the maker's works after grinding and polishing the surfaces but prior to application of insulation. The vessel shall not leak after approximately two hours when filled with water up to the brim. It shall be ensured that the silo is sound and does not show undue distortion that may lead to the failure of the silo.

10. MARKING

10.1 The silo shall be marked legibly and permanently with the following particulars:

- a) Manufacturer's name or trade-mark or initials,
- b) Manufacturer's identification, and
- c) Capacity of the silo.

10.1.1 Each silo may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

*Code of practice for liquid penetrant flaw detection (*first revision*).

†Recommended practice for radiographic examination of fusion welded butt joints in steel plates (*second revision*).

‡Recommended practice for radiographic inspection of fusion welded butt joints in steel pipes (*first revision*).

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition</i>
Force	newton	N	1 N = 1 kg. m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²